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EXAMINER
SOUW, BERNARD E

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2881	

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Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 09/837,733	Applicant(s) PEPPER ET AL.	
	Examiner Bernard E Souw	Art Unit 2881	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *18 April 2001* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-30* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-30* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *18 April 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO-1449) Paper No(s) *2 & 5* .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Specification

1. The disclosure is objected to because it does not describe the item shown by numeral 60 in Fig.1, which is obviously different than the same numeral 60 in Fig.3.

Appropriate correction is required.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 1, 2, 19, 29 and 30 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang (USPAT # 4,005,935) in view of Anafi et al. (USPAT # 4,996,412).

Wang invents a system for focusing electromagnetic energy on a target comprising:

(a) first means for providing a pilot beam of electromagnetic energy, as shown by laser unit10 in Fig.1 (=laser beacon of claim 2) and recited in Col.2/ll.26-32;

(b) second means for receiving a wave front due to reflection of the pilot beam from the target, as shown in Fig.1 by element 32 (Brillouin mirror), as recited in Col.2/ll.38-41;

(d) fourth means (reflection from Brillouin mirror 32) for providing an output beam, as recited in Col.2/ll.42-48, which is predistorted (by the Brillouin mirror 32), to compensate for distortions and other phase and/or amplitude information in the received wave front, as specifically recited in Col.2/ll.48-53, whereby the output beam is focused at the target, as specifically recited in Col.2/ll.45-48-48.

However, the compensation for phase distortion in Wang's system is performed passively, or automatically, by the Brillouin mirror 32, instead of in response to the data provided by (c) a third means for analyzing the received wave front from the target and providing data in response thereof.

A third means for analyzing the received wave front from the target and providing data for compensating the phase distortion is *well known in the art* as *Adaptive Optics* (AO), whereby the wave front analysis is carried out by a wave front sensor WFS and the data is passed on to a deformable mirror that compensates the phase distortion by predistorting the output beam. Such a third means is, for example, rendered obvious by Anafi et al. (but also by many others as generally known in the art).

Anafi et al. disclose a system for wave front compensation as shown in Fig.1, comprising a first means (laser 10) for providing a pilot beam of electromagnetic energy (beam path 110-120-141-160), as recited in Col.2/ll.15-16 & 57-59; second means (optical elements 50, 40, 20, 25 and 30) for receiving a wave front due to reflection of the pilot beam from a target 60 (return beam path 161-140-121-126-131-37), as recited in Col.2/ll.56-65; third means, i.e., a wave front sensor 37 for analyzing the received wave front from the target (i.e., the beacon return beam path 161-140-121-126-131-37),

as recited in Col.3/ll.2-8, and further, for providing data in response thereto, as recited in Col.3/ll.8-11 (i.e., to deformable mirror 40) for compensating the phase distortion in the beacon beam (path 161-140-121-126-131), and further, providing data to a (high power) output beam 140 & 160 by means of deformable mirror 40 that *predistorts* the (high power) output beam 140 &160 to compensate for distortions and other phase and/or amplitude information in the received wave front, as recited in Col.3/ll.8-11.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify Wang's by Anafi's system, i.e., using a wave front sensor (WFS) and a deformable mirror to compensate the phase distortion, since the latter is a modern version that is much more versatile than the passive system of Wang.

Note, Anafi's system uses two wavefront sensors (WFS), 35 & 37, and two deformable mirrors 25 & 40 as shown in Fig.1, in order to compensate both phase variations within the laser generating the beam (loop 35-36-25, complemented by the phase conjugate mirror 15) and those generated within the atmosphere through which the beam propagates, as recited in Col.1/ll.11-24. Although Anafi's embodiment differs from Applicant's specific embodiments described in the disclosure, the latter were not claimed explicitly. Nor were the words that are used in the claims defined in the specification to require these limitations. A reading of the specification provides no evidence to indicate that these limitations must be imported into the claims to give meaning to disputed terms. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). Therefore, Anafi's invention, although narrower in its limitations, is

completely valid and sufficient to reject Applicant's claims 1, 19 and 30 having broader limitations.

However, in case claims 1, 19 and 30 are narrowed down so as to exclude the first compensation (within the laser beam itself), that specific limitation may be simply eliminated, i.e., Anafi's compensation loop (35-36-25) may be discarded and the phase-correcting information from beacon WFS 37 is directly fed to the deformable mirror 40. In a *stationary* case, Anafi's beacon WFS 37 would not measure the *original* phase of the beacon signal received from target 60, since the returned beacon beam 161-140-121 would already have traversed the phase compensating effect of the deformable mirror 40. In one Anafi's particular embodiment, this doubled effect is circumvented by operating the system in a pulsed mode, as recited in Col.2/ll.18-55, specifically in ll.33-36 and further elucidated in Col.3/ll.3/12-35. However, even in the stationary case, it is well known in the art that Anafi's system (i.e., with the mirror 40 positioned as illustrated in Fig.1) would still work properly if the double effect of the deformable mirror 40 is taken into account by the wave front analyzer & deformable mirror controller 38, which, in its state-of-the-art form, includes a real-time data processor (e.g., by providing only half the strength of the phase distorting data to the deformable mirror 40).

Otherwise, as generally known in the art, the deformable mirror 40 should be placed so as not to impact on the beacon return beam path 161-140-121-125-131-37, e.g., between laser 10 and beam splitter 20. In such a case, only one deformable mirror is used and the passive phase conjugator 15 can be discarded, too, since it is not

needed. Although Anafi's claims are more specific, such a narrower claim is valid for rejecting a broader claim, as Applicant's.

It is to be noted that the specific modification regarding this alternative location of deformable mirror 40, *as suggested as an alternative to original Anafi's by the Examiner* (but **not** by Applicant's claim) are not specifically or expressly taught by the cited prior arts. In this regard, the rationale to modify the reference of Wang and Anafi's by putting Anafi's mirror 40 to its alternative location *as suggested as an alternative to original Anafi's by the Examiner* (**not** by Applicant's claim) does not have to be expressly stated in the prior arts; in the present case the rationale is reasoned from knowledge generally available to one of ordinary skill in the art. *In re Fine*, 837 F.2d 1071, 5 USPQ2d 1596 (Fed. Cir. 1988); *In re Jones*, 958 F.2d 347, 21 USPQ2d 1941 (Fed. Cir. 1992).

The Examiner takes the Official Notice that all the AO features described in the various embodiments of the disclosure, but not necessarily recited in the claims, are well known in the art. A specific prior art will be given *only after* more specific AO features have been incorporated by Applicant into the claims, i.e., after the claims have been narrowed down. For these reasons, any later identification of prior art given by the Examiner should not be interpreted as new ground(s) of rejection. Some of these prior arts are already applied to the dependent claims in this Office Action.

▶ Claim 30 recites the same limitations as claim 1. Specifically, the first limitation is the same as claim 1(a), the second limitation is the same as claim 1(b), the third limitation is the same as claim 1(c) and the fourth limitation is the same as claim 1(d). Therefore, claim 30 is rejected by the same reason over the same prior arts as claim 1.

▶ Claim 19 also recites the limitation of a starlight in place of a laser beacon. The use of natural stars or artificial stars in AO systems to replace laser beacons placed at the target or reflected from target surface is well known in the art. This Official Notice is rendered obvious by a large number of prior arts, whereby it is further well known in the art that the use of more than one natural stars are known to substantially increase the AO system's field of view (FOV).

With the starlight replacing the beacon in claims 1 and 30, the further limitations of claim 19 are rendered obvious by Wang in view of Anafi et al.. In particular, the first limitation (with the laser beacon replaced by star light) is the same as claim 1(a), the second limitation is the same as claim limitation 1(b) and/or 1(d), in which limitation 1(c) is inherently implicated.

▶ Regarding claim 29, Wang implement the first means of claim 19 (analyzing the beacon laser) and second means (predistorting the output beam) with an optical phase conjugate mirror 32 shown in Fig.1, as recited in Col.3/ll.31-55.

4. Claims 4-5, 8-12, 18, 20-24 and 29 are also rejected under 35 U.S.C. 103(a) as being unpatentable over Wang in view of Anafi et al.

▶ Regarding claim 4, Wang's system comprises a telescope 18 shown in Fig.1, as recited in Col.29-32.

▶ Regarding claims 8 and 20, the recitation of a wave front error sensor is rendered obvious by Anafi et al. in numeral 37 (and 35) shown in Fig.1, recited in Col.2/ll.30-46.

▶ Regarding claim 9, the recitation of providing an output beam which is a phase conjugate of the received wave front is rendered obvious by Wang in Col.2/ll.42-53, and by Anafi et al. in Col.3/ll.12-35.

▶ Regarding claims 10 and 22, the recitation of a deformable mirror is recited by Anafi et al. in Col.2/ll.62-65.

▶ Regarding claims 11 and 21, the recitation that the mirror control means for controlling the deformable mirror is responsive to the wave front sensor 37 (for detecting phase errors in received *beacon* laser beam or star light) is rendered obvious by Anafi et al. in Col.1/ll.21-24, Col.2/ll.33-36 and Col.3/ll.4-11.

▶ Regarding claims 12 and 24, the recitation of a laser illuminating the deformable mirror to provide the output beam is recited by Anafi et al. in Col.2/ll.33-55.

▶ Regarding claim 23, the limitation is the same as that of claims 1(d) and 11.

▶ Regarding claims 18 and 29, the use of phase conjugate mirror is rendered obvious by Anafi et al., showing in Fig.1 a phase conjugate mirror 15, as recited in Col.2/ll.16-19.

5. Claims 3, and 5-7 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang in view of Anafi et al. and further in view of Livingston (USPAT # 5,973,309) and Stappaerts (USPAT # 5,378,888).

Wang as modified by Anafi et al. shows all the limitations of claims 3, 6 and 7, as previously applied to the parent claim 1 and 5, except for specific limitations that are to be addressed individually, as follows:

▶ Regarding claim 3, the limitation of a beacon laser that is mounted off-axis is rendered obvious by Livingston, as shown in Fig.1 by tracking system 10 which emits a beacon or pilot beam T off-axis with respect to the main (tracking) device 16. Alternatively, as shown in Fig.3 Stappaerts also directs a beacon laser beam 37, which is divergent, and off-axis to the axis of the receiver's optic 40, as r4ecited in Col.1/ll.60-68 and Col.2/line 1.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use a beacon that is mounted off-axis as taught by Livingston and/or Stappaerts, thereby using a glint emitted from the target surface either under a scanned beacon beam, as taught by Livingston in Col.3/ll.4-10 & col.4/ll.22-340 & 35-45, or a divergent beacon laser beam as taught by Stappaerts in Col.1/ll.60-68 & Col.2/line 1, since an off-axis and scanned or divergent beacon has a (much) wider angle of view that makes the target acquisition (much) easier.

▶ Regarding claim 5, the recitation that the telescope as used by Wang is gimbaled is well known in the art, as rendered obvious by Livingston, showing in Fig.1 a beacon laser 14 and a tracking receiver 16 on a gimbal mount 18, as recited in Col.3/ll.52-55.

It would have been obvious to one of ordinary skill in the art at the time the invention was made to put the beacon laser and/or the tracking receiver's optics on a gimbal mount, since a gimbal mount provides the best flexibility and maneuverability in a telescope's pointing direction.

► Regarding claim 6, Livingston's target tracking system 16 comprises a detector 32 in optical alignment with a telescope 28, as shown in Fig.2 and recited in Col.3/ll.47-67 & Col.4/ll.1-45.

► Regarding claim 7, a tracking processor is comprised in Livingston's system, as recited in Col.4/ll.22-67 & Col.5/ll.28, and also by Stappaerts in Col.2/ll.1-10 in numeral 32.

6. Claims 13-17 and 25-28 are rejected under 35 U.S.C. 103(a) as being unpatentable over Wang in view of Anafi et al. and further in view of Pepper (USPAT # 4,767,195) and general knowledge in the art.

Wang as modified by Anafi et al. shows all the limitations of claims 13-17 and 25-29, as previously applied to the parent claims 12 and 24, except for the limitation of modulating the output beam and other claim limitations to be addressed below.

Modulation of the output beam is desired in case the system is intended for jamming optical communications and confusing the navigational system of the target. As generally known in the art, optical communications to and from space satellites and navigational systems of ballistic missiles are carried out by modulated optical signals. While Pepper's reference is only one of the many conventional methods of modulating optical communication signals, there is an abundance of optical *phase* as well as *intensity* modulators up to 10 Gbps modulation frequencies available in the commercial market today.

Claims 13-17 and 25-28 recite limitations regarding methods and instrumentation *conventionally* used for implementing these optical modulations. These conventional methods and instrumentations are also well known in the art. This Official Notice taken by the Examiner is here supported by a large number of references and prior arts, as disclosed by Pepper (USPAT 4,767,195), which is just one among many others.

▶ Specifically regarding claim 25, the limitation of modulating the laser output beam is desired in case the IRCM is intended for jamming optical communications or navigation of a guided missile, as accomplished by the TADIRCM system of the US Navy that began already in 1997 (see downloaded Global Security webpage, listed in PTO-892), successfully flight-tested in August 1999 (see downloaded Sanders News Releases, listed in PTO-892), and completed a final major test in November 2001 (see Global Security webpage and BAE Systems Vol. II, No.18, October 22, 2001, both listed in PTO-892).

▶ Specifically regarding claims 26-27, the limitation of detecting a modulation in a beam received from the target is well known to one of ordinary skill in the art, since an effective jamming (i.e., using low power not exceeding, or even much below, the jam/signal ratio of the target system) can be easily achieved by modulating the jamming signal at the same frequency as the frequency used in the communication/navigation of the target system, as disclosed in the second section of the downloaded webpage of Military Review, March-April 2001, page 12, under the title "GPS Signals Jammed During Tank Trials" based on a real incident in 2000 also reported to the public in the same year. Although jamming the GPS guidance is done at some RF frequency, it is

known in the art that the same method would equally work in optical frequencies, since both are of the same nature, i.e., electromagnetic waves.

It would have been obvious to one of ordinary skill in the art, that, in order to implement the method described in the Military Review above, the carrier and modulation frequencies of the target system must first be known, i.e., by previously detecting it (claim 26) then transferring it to the laser output beam to do the jamming, preferably in a closed-loop system which conventionally includes a system controller, as recited in claim 27.

▶ Specifically regarding claim 28, the limitation of modulating by means of an electro-optic shutter disposed in the path of the output laser is conventional in case of intensity modulated optical signal. Such optical modulators are available in the commercial market at least since 1999, as evidenced, just for example, by the downloaded websites of two companies, ERA Technology and Electro-Optical Products Corporation, both listed in PTO-892.

7. The many Official Notices recited by the Examiner were made due to the general knowledge in the art, the abundance of references and/or prior arts, as well as due to the broadness of Applicant's claim. Consequently, picking up one or two of them in the next Office Action in case the Official Notice is challenged by the Applicant, or in case a claim is narrowed down by the Applicant, will not constitute a new ground for rejection. For example, regarding claim 19 the Official Notice on the use of natural (or artificial) star is supported, e.g., by Potter (USPAT # 5,528,493) as recited in Col.3/ll.22-30, and

further, by Chun et al. (Gemini Preprint #60, see PTO-892), as recited in the Abstract line 6.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Bernard E Souw whose telephone number is 703 305 0149. The examiner can normally be reached on Monday thru Friday, 9:00 am to 5:00 pm..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John R Lee can be reached on 703 308 4116. The fax phone numbers for the organization where this application or proceeding is assigned are 703 872 9318 for regular communications and 703 872 9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703 308 0956.

bes
May 15, 2003

JOHN R. LEE
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